

1. INTRODUCTION AND NEW INTERNATIONAL EQUATORIAL OBSERVATORY (NIEO)

1.1 THE MIDDLE ATMOSPHERE PROGRAM: AN OVERVIEW

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The Middle Atmosphere Program (MAP) took place from January 1, 1982 through December 31, 1986, and was followed by Middle Atmosphere Cooperation (MAC) through to the end of 1988. The inception and organization of the program are described, together with some of the salient features of its results.

REGIONS OF THE ATMOSPHERE

Troposphere 0-17 km
Stratosphere 17-50 km
Mesosphere 50-85 km
Thermosphere 85 km

Middle atmosphere consists of the stratosphere and mesosphere.

RELEVANCE OF THE STRATOSPHERE

Ozone layer effects
Chlorofluorocarbon effects
Clear air turbulence
Radioactivity residence times
Scatter communication

RELEVANCE OF THE MESOSPHERE

Modeling for aerospace applications
Communication by meteors, etc.
Radio absorption effects

AIMS OF MAP

"Under the aegis of MAP, scientists will collaborate internationally

1. To determine the structure and composition of the atmosphere in the regions of the stratosphere and mesosphere, i.e., in the approximate altitude range 15 to 85 km; especially in regard to important minor species.
2. To determine the interaction of radiation from the sun, the earth and the atmosphere with the middle atmosphere.
3. To investigate the motions of the middle atmosphere on all scales, including the interactions with the troposphere and magnetosphere, and to monitor these motions on a continuing basis."

SOURCES OF ENERGY IN THE SOLAR-TERRESTRIAL SYSTEM

Tides, gravity waves, planetary waves, solar ultraviolet radiation, solar X-radiation, cosmic rays, magnetospheric electric fields, energetic particle precipitation, global electrical circuit.

MAP STEERING COMMITTEE

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T. E. VanZandt, URSI
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MAP STUDY GROUPS AND CHAIRMEN

MSG-1: Tropospheric-Stratospheric Coupling, Chemical and Dynamical, J. R. Holton
MSG-2: Transport of Trace Constituents, J. D. Mahlman
MSG-3: Tides, Gravity Waves and Turbulence, M. A. Geller
MSG-4: Electrodynamics of the Middle Atmosphere, H. Volland
MSG-5: Ions and Aerosols, F. Arnold and M. P. McCormick
MSG-6: Scientific Aspects of an International Equatorial Observatory, S. Kato
MSG-7: Penetration of Solar Radiation into the Atmosphere, J. E. Frederick
MSG-8: Atmospheric Chemistry, G. Witt
MSG-9: Measurement of Middle Atmosphere Parameters by Long Duration Balloon Flights,
J. E. Blamont

PRE-MAP PROJECTS AND CHAIRMEN

PMP-1: Coordinated Study of the Middle Atmosphere in Winter, K. Labitzke
PMP-2: Equatorial Wave Dynamics, I. Hirota
PMP-3: Study of Photochemical Processes in the Upper Stratosphere and Mesosphere by
Complementary Spacecraft, *in situ*, and Ground Measurements, J. Gille
PMP-4: Presentation of Meteorological and Chemical Variables in the Format of Monthly
Mean Zonal Cross Sections, J. Barnett
PMP-5: Solar Spectrum Irradiance Measurements, P. C. Simon

MAP PROJECTS AND COORDINATORS

AMA: Antarctic Middle Atmosphere Program, T. Hirasawa
ATMAP: Atmospheric Tides in the Middle Atmosphere Program, J. M. Forbes
DYNAMICS: Dynamics of the Middle Atmosphere in Winter, K. Labitzke
GLOBMET: Global Meteor Observation System, R. G. Roper
GLOBUS: Global Budget of Stratospheric Trace Constituents, D. Offermann
GOSSA: Global Observations and Studies of Stratospheric Aerosols, M. P. McCormick
GRATMAP: Gravity Waves and Turbulence in the Middle Atmosphere Program, D. C. Fritts
MAC-EPSILON: The project is planned as a case study of middle atmosphere turbulence by
measure of instrumented sounding rockets, meteorological rockets and ground-based
observations, E. V. Thrane
MAC-SINE: Middle Atmosphere Cooperation - Summer in Northern Europe, E. V. Thrane
MAE: Middle Atmosphere Electrodynamics, R. A. Goldberg
MASH: Middle Atmosphere of the Southern Hemisphere, A. O'Neill
NIEO: New International Equatorial Observatory, S. Kato
OZMAP: Observations of, and Sources of the Spatial and Temporal Variability of Ozone in the
Middle Atmosphere on Climatological Time Scales, D. F. Heath
SSIM: Solar Spectral Irradiance Measurements, P. C. Simon
SUPER CAMP: This project is a follow-on of CAMP (Cold Arctic Mesopause Project) and
will focus on a study of the middle atmosphere above the northern polar region from
50° to 80° during the summer, in the effort to understand latitudinal variability of
vertical transport, wave dissipation, and its implications on densities of minor
constituents, E. Kopp
WINE: Winter in Northern Europe, U von Zahn

MAP HANDBOOK TOPICS AND VOLUME NUMBERS

Study Group Reports: 1, 3, 8, 11, 17, 21
 Technique Handbooks: 13, 15, 19
 Project Reports: 1, 3, 4, 8, 11, 12, 17, 21
 National Plans and Reports: 1, 4, 8, 9, 11, 17, 21
 Steering Committee Minutes: 3, 4, 8, 11, 17, 21, 26
 MAP Assembly Proceedings: 4, 17
 Directories: 6, 24
 Regional Definition Group Reports: 4
 Symposium Papers: 2, 10, 18, 25
 Workshop Reports: 8, 9, 11, 12, 14, 17, 20, 21
 Data Presentation Handbooks: 5, 12, 16, 22

SCIENTIFIC DESIDERATA

For winds studies; for tidal studies; for gravity waves; for turbulence studies; for studies of mesoscale effects and for studies of chemistry.

PROBLEMS WITH CURRENT TECHNIQUES

Height coverage; height resolution; time resolution; measurement of spectral parameters; monostaticity; and poor geographical distribution.

FUTURE PROGRAMS OF OBSERVATION

MAP/MAC now concluding
 MAC-EPSILON
 Definition and purpose of MAS
 Relationship to GIS and STEP
 New equatorial observatory
 Upgrading of existing facilities
 Data analysis phase

DIVIDENDS FROM MAP

- More groups working
- Greater international communication
- Prototype for small international programs
- Increased funding agency awareness
- Scientific interest in stratosphere added to operational interest
- Increased awareness of interdisciplinary aspects
- Satellite groups now driven by user pressure

LESSONS FROM MAP

- Clear definition of area
- Early preparations for national participation
- Study groups to define needs
- Pre-projects to exercise cooperative efforts
- Project structure not imposed from above
- Workshops actively encouraged
- Publications must be uniform and timely
- Alertness for new techniques
- Unite techniques in campaigns
- Take advantage of all symposium opportunities
- MAP area now fully defined and flourishing